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Climate Change Mitigation Policies Conventional Versus Sustainable Development Scenarios in Emerging Economies

Kirsten Halsnæs (DTU) and P. Shukla (IIM India)



SD Framing of Climate Policies

- The paper explores how bottom up driven sustainable development policies can support climate change mitigation as an alternative to the COP process
- SD policies with large indirect impacts on CC mitigation includes energy efficiency improvements, renewable energy, environmental policies, and economic growth patterns:
 - recognizing that models are structured to assess optimal global CC mitigation policies (e.g. with a uniform carbon tax)
- Our approach is to change the baseline scenario and include various policies that support SD objectives and compare mitigation costs and options with conventional baselines
- Focus on China and India based on studies with:
 - TIAM
 - IPAC for China by Jiang Kejun, ERI
 - ANSWER MARKAL for India by P. Shukla, IIAM
- CC mitigation is assessed in relation to conventional baseline and to SD baseline

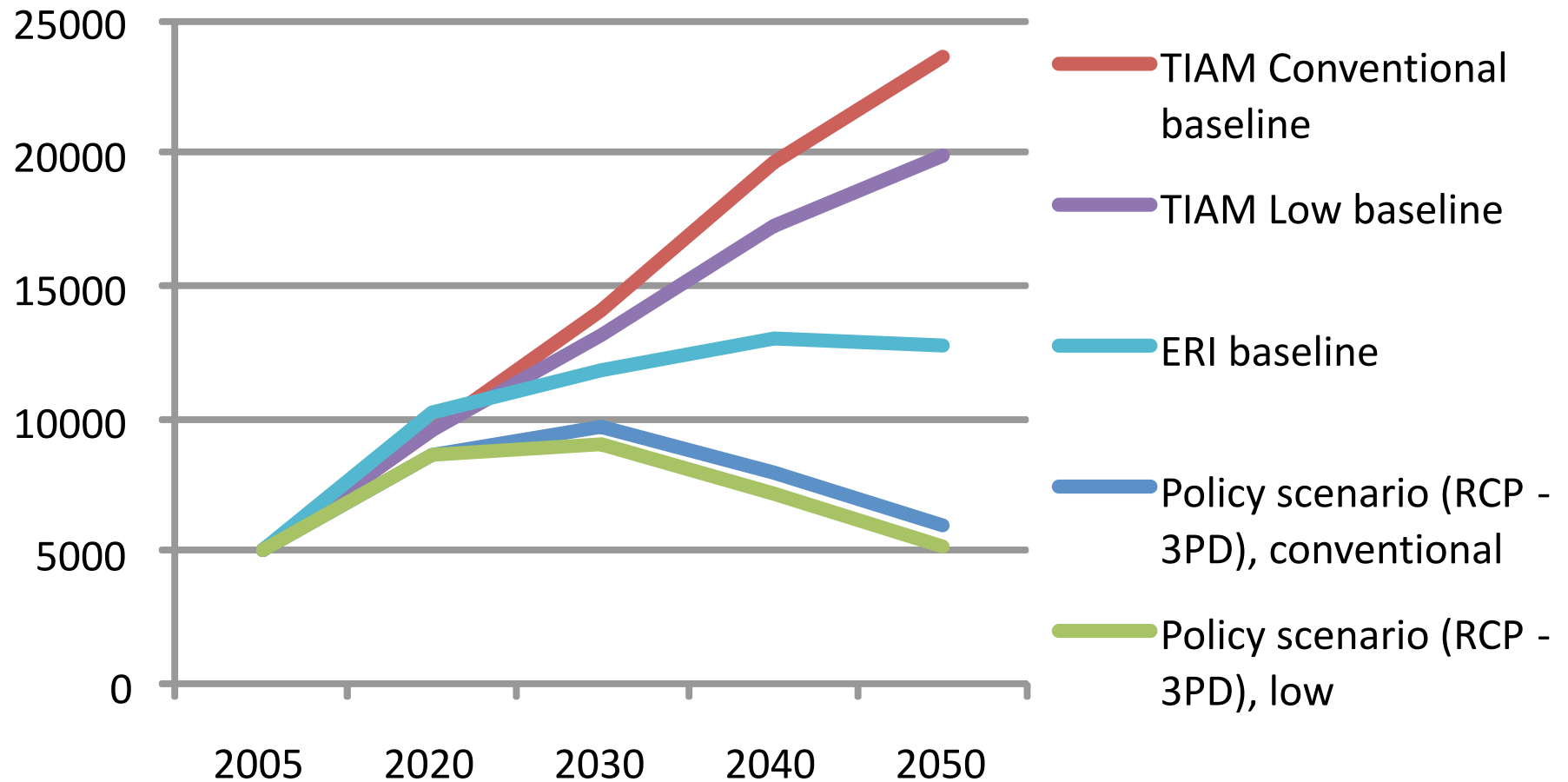
Baseline Policy Categories

- GDP growth and sectoral structure (TD):
 - Continuation of high economic growth rates in China and India
 - Industrialisation towards less energy intensive sectors
- Energy intensity of growth (TD):
 - Industry and other business
 - Households
- Technological change (BU):
 - Energy supply
 - End use technologies
- Renewable energy (BU):
 - Targets
 - Potentials

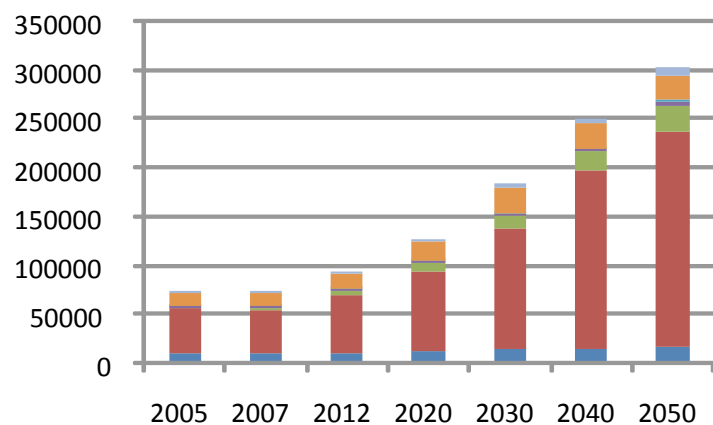
Study coverage

- IPAC China:
 - High GDP growth rate
 - Efficiency improvements in industry, households and transportation
 - Renewable energy targets
 - Technological change in supply technologies
- TIAM:
 - Medium growth rates assumed for China and India
 - Efficiency improvements in industrial processes
 - IPAC renewable energy potentials
- ANSWER-MARKAL India:
 - High GDP growth rate
 - Changed sectoral structure
 - Efficiency improvements in industry, households and transportation
 - Renewable energy targets
 - Technological change in supply technologies

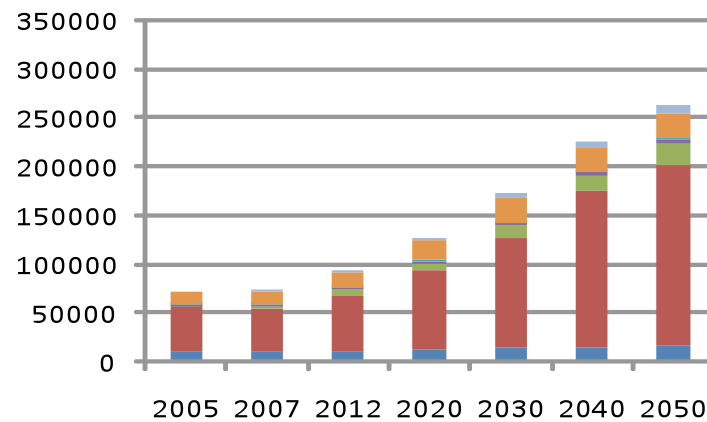
Chinese CO₂ emissions (Mt)



Primary energy by fuel in conventional baseline (PJ)

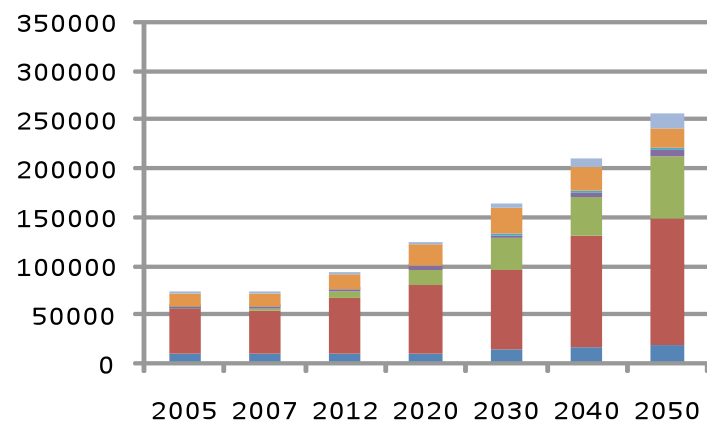


Primary energy by fuel in low baseline (PJ)

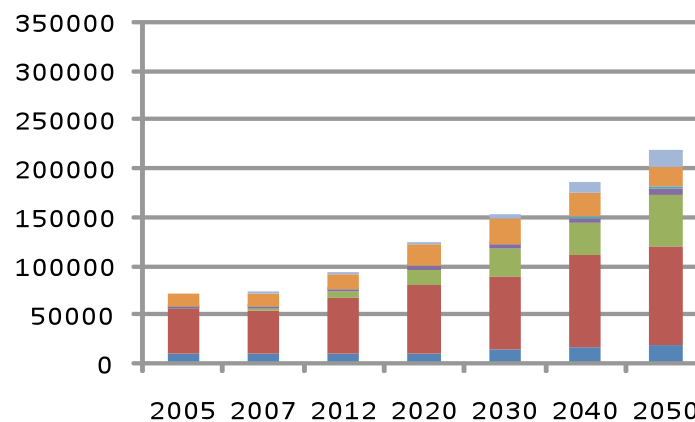


- Renewable except hydro and biomass
- Oil
- Nuclear
- Hydro
- Gas
- Coal
- Biomass

Primary energy by fuel in conventional policy scenario (PJ)

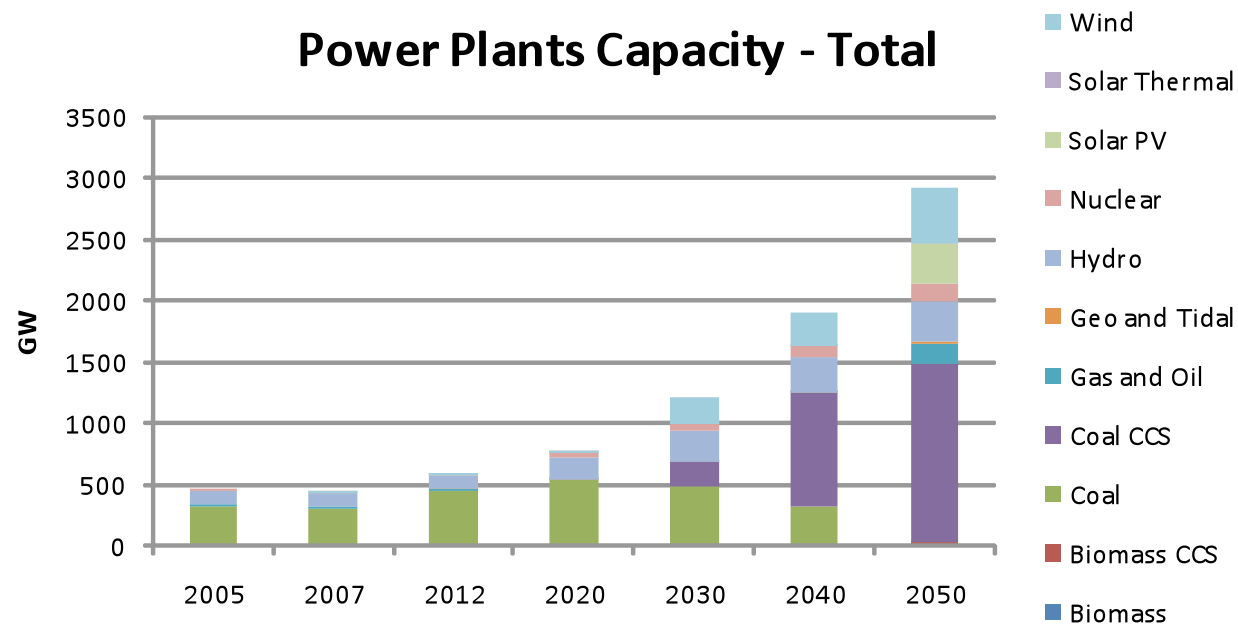


Primary energy by fuel in low policy scenario (PJ)



- Renewable except hydro and biomass
- Oil
- Nuclear
- Hydro
- Gas
- Coal
- Biomass

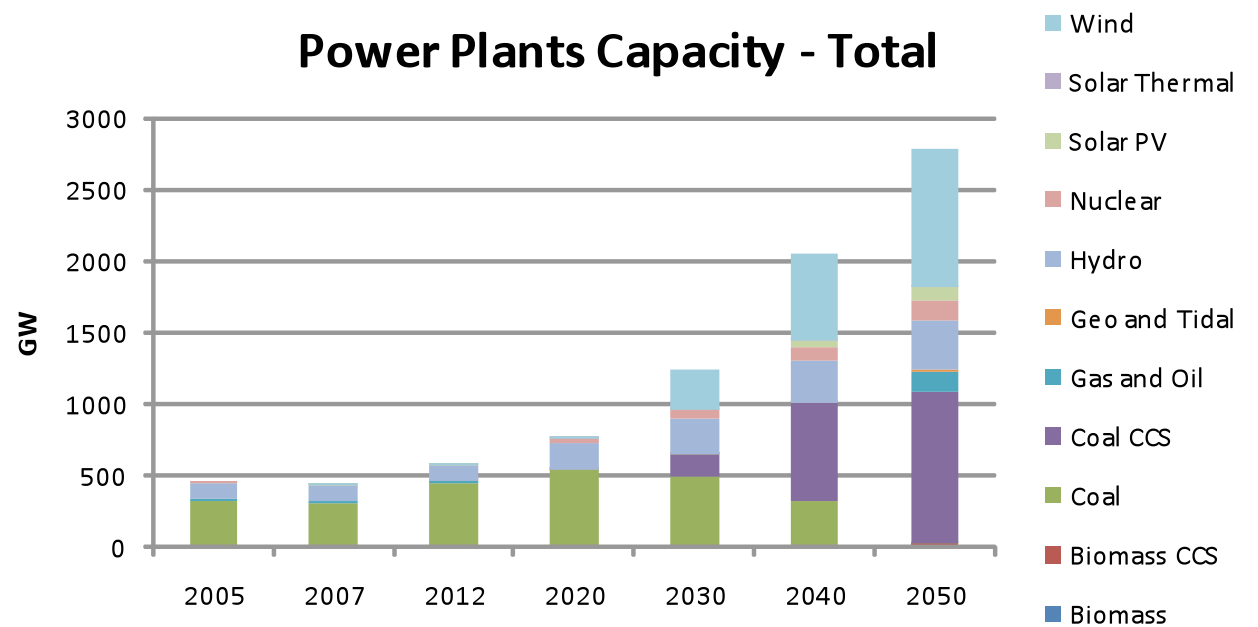
Power Plants Capacity - Total



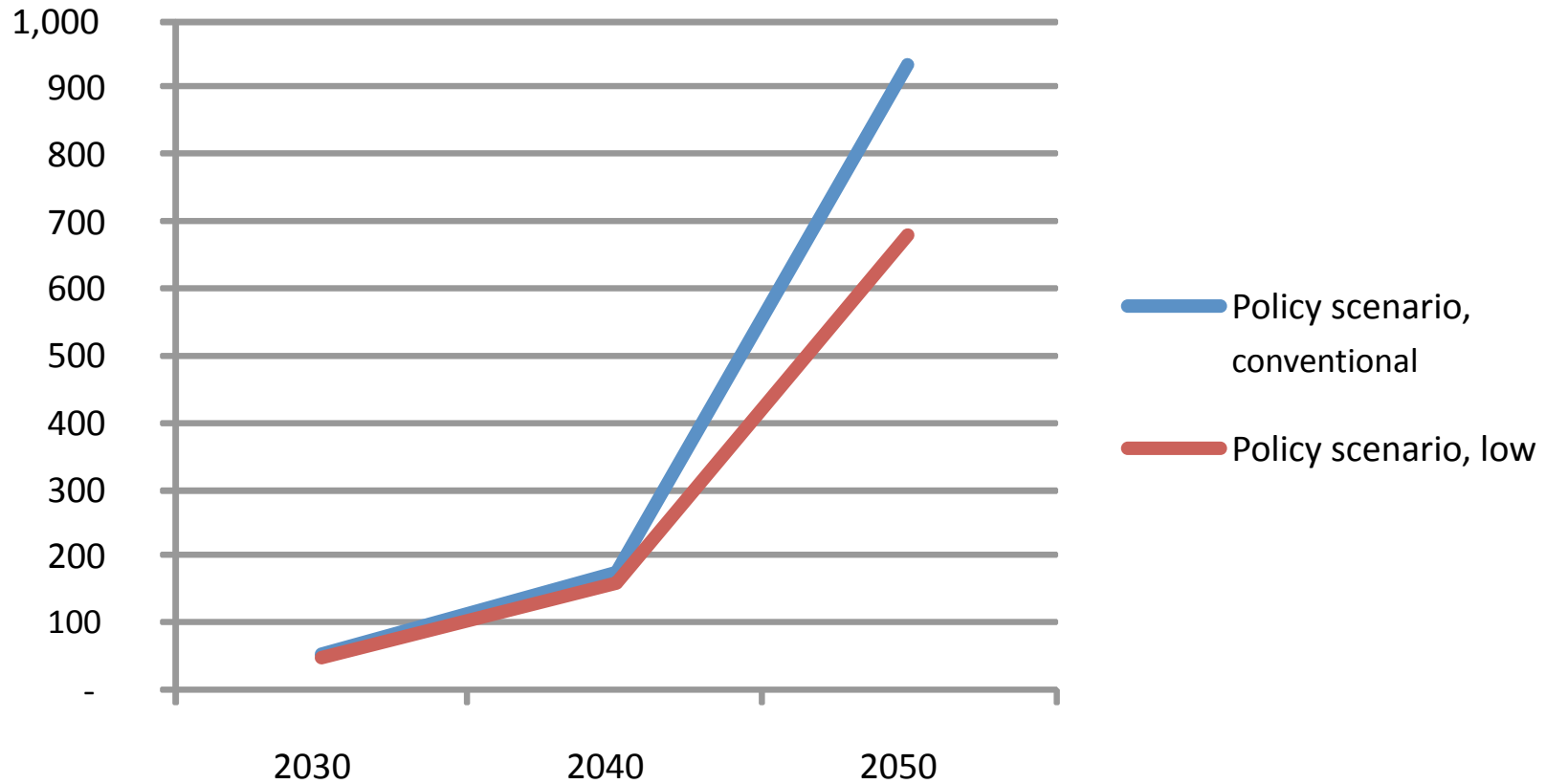
Conventional PS

Low PS

Power Plants Capacity - Total



CO2 price TIAM



Indian SD Scenario

- **Focus on:**
 - Mainstreaming climate actions in development plans/policies/processes
 - Lower energy and carbon intensity of development
 - Up-front decisions to avoid long-term lock-ins
- **Elements:**
 - Behavioral, technological, and institutional change which promote resource conservation
 - Dematerialization
 - Demand substitution (e.g. information for transport)
 - Urban planning and sustainable transportation
 - Sustainable land use
 - Regional collaboration about energy, water, and forest resources

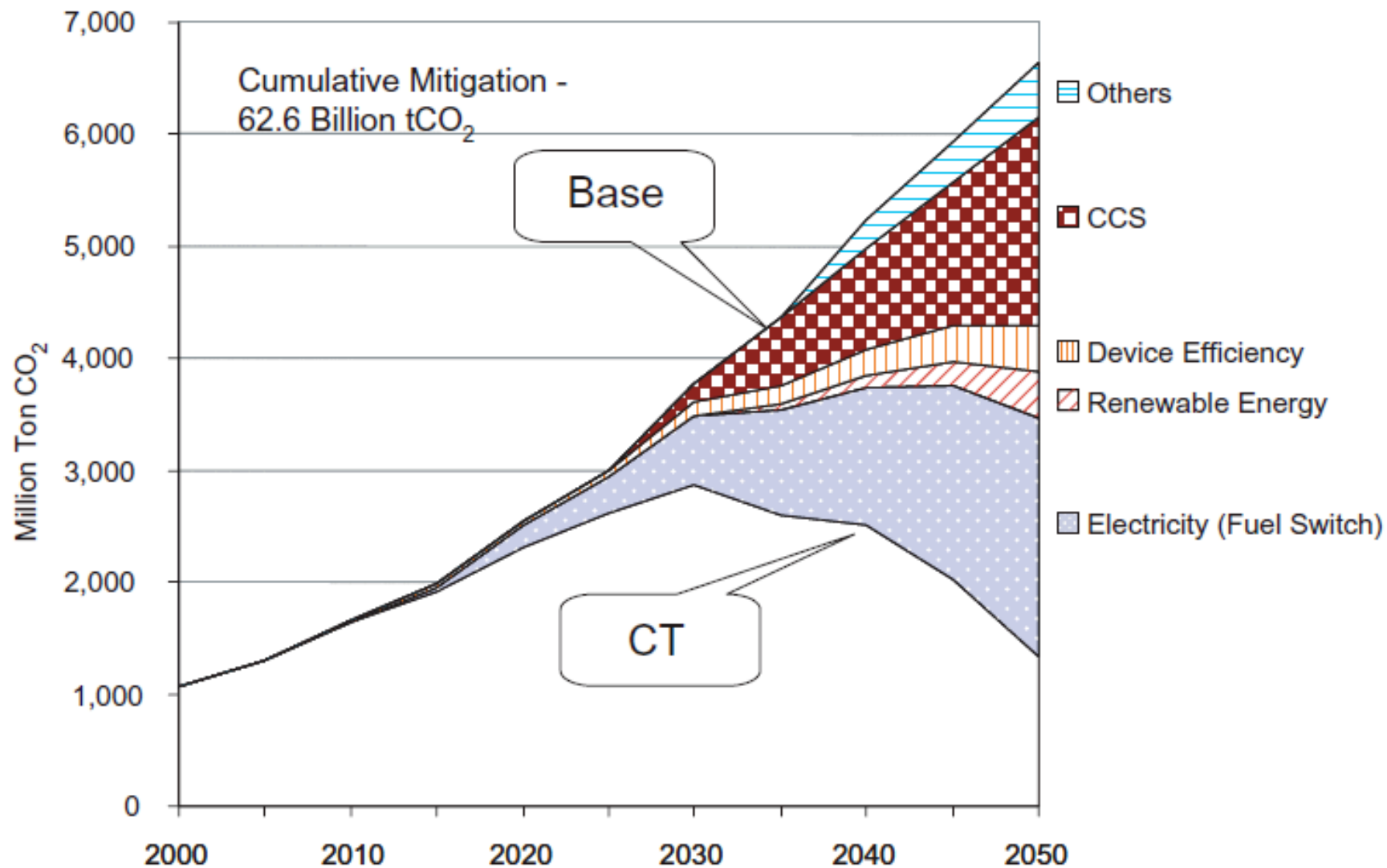


FIGURE 5 Mitigation options in the Carbon tax scenario.

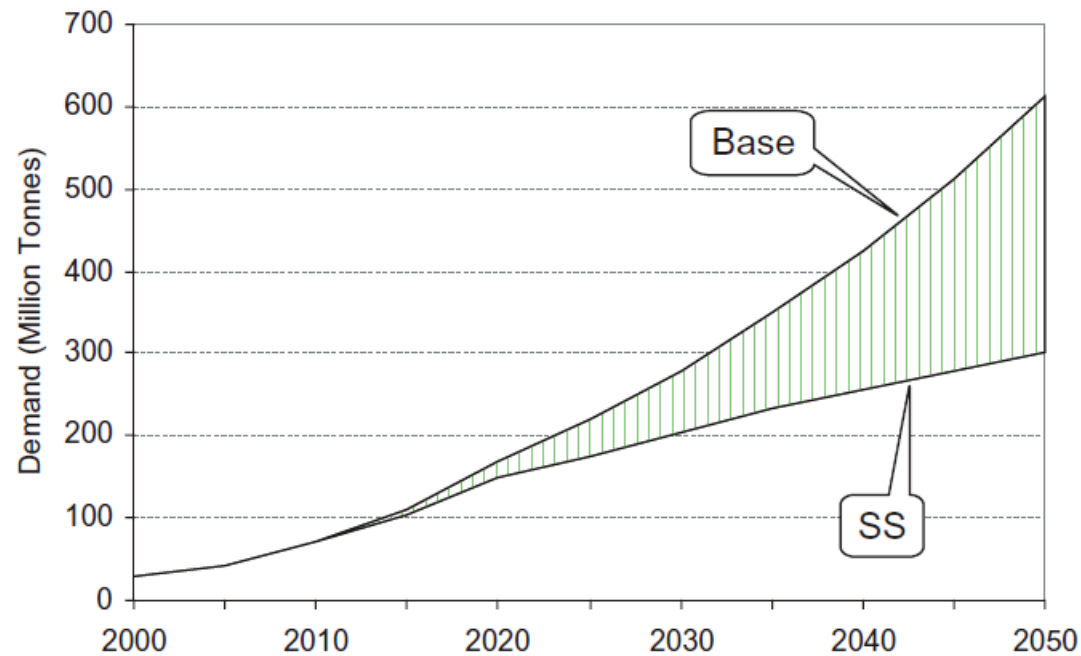


FIGURE 7 Carbon demand of steel industry 2000–2050 under the Base case and Sustainable society scenarios.

TABLE 3 Impact of sustainable drivers on steel demand

Sector	Driver	Impact on steel demand
Transport	Urban planning	Fewer automobiles, Less road transport infrastructure
	Modal shift	
	Substitution	
Building	Building design	More local materials,
	Material substitution	Low-rise buildings

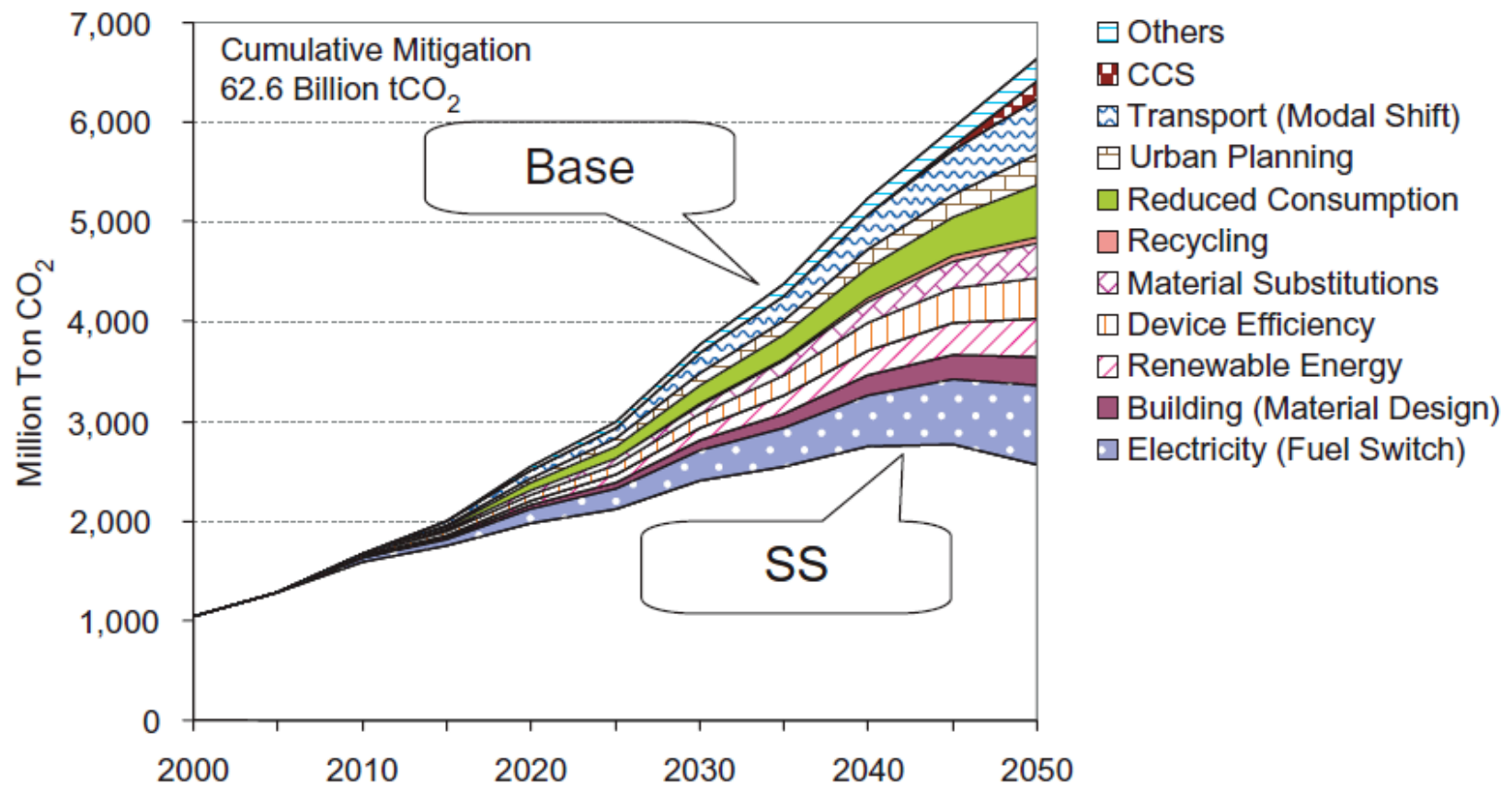


FIGURE 8 Mitigation options in the Sustainable society (SS) scenario.

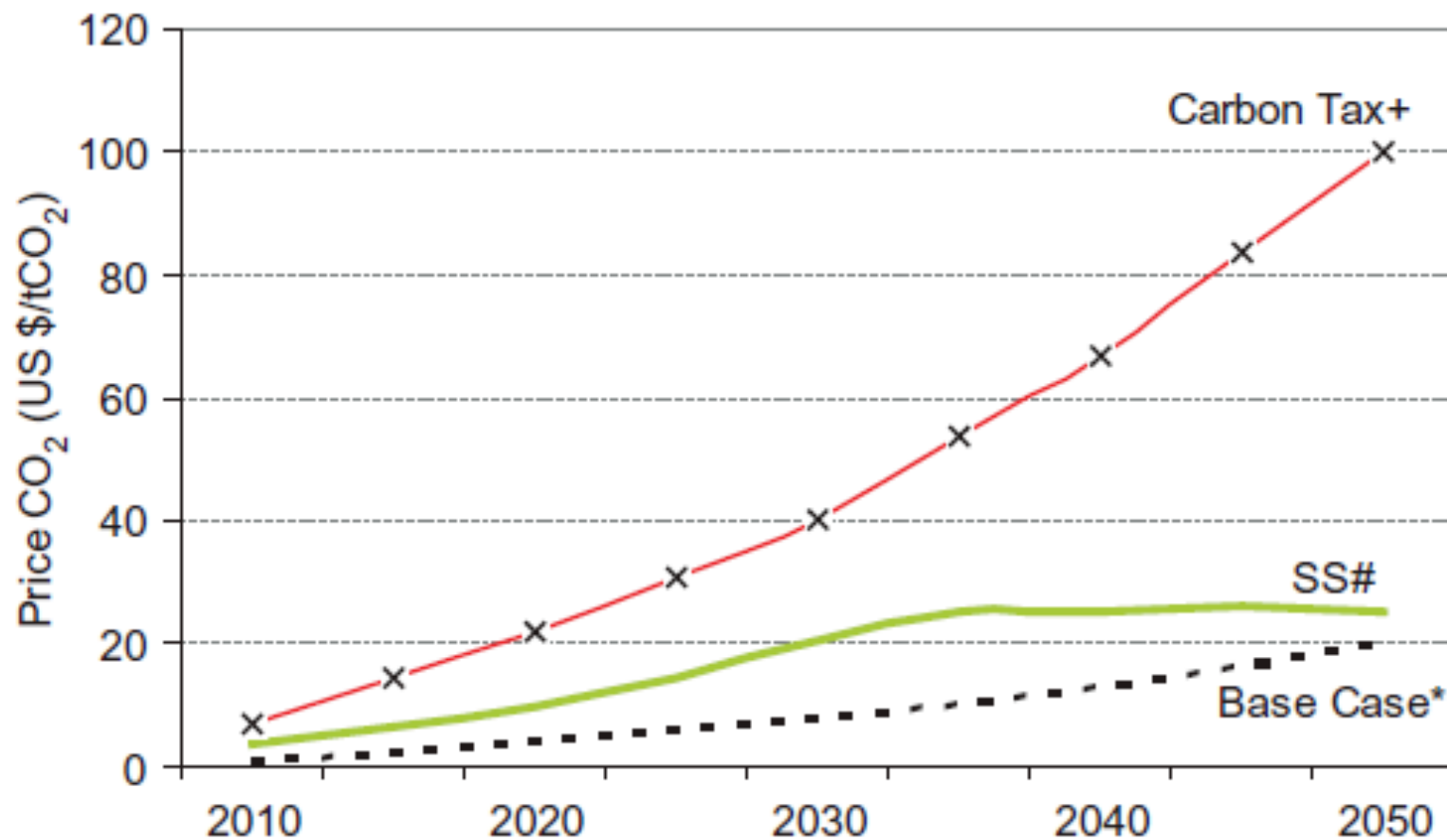


FIGURE 12 Carbon price in the LCS and Base case scenarios.

(*) Carbon price conforms to the global tax trajectory for 650 ppmv stabilization of CO₂e.

(#) Carbon price is the shadow price when for mitigation equivalent to CT scenario in the SS scenario.

(+) Carbon price conforms to the global tax trajectory for 550 ppmv stabilization of CO₂e.

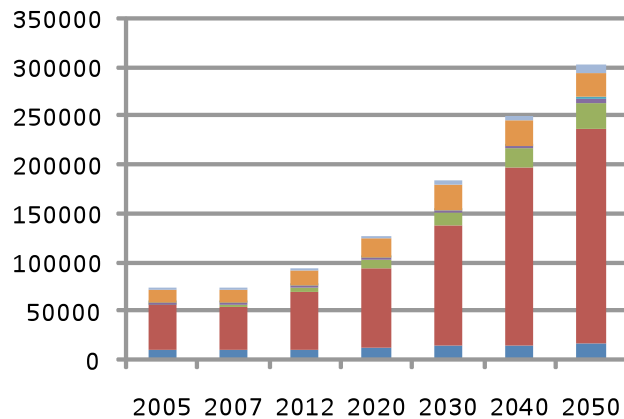
Conclusions

- Studies with TIAM, IPAC China, and Answer MARKAL India show very large differences between mitigation policies assessed in relation to a conventional baseline and in relation to a SD baseline
- Portfolio of mitigation options change with baseline
- Marginal cc mitigation costs change with baseline, but these costs become less important in relation to policy making. Baseline SD policy costs become relevant
- Models are not well developed in order to reflect SD policies in terms of alternative economic growth patterns, energy intensity, and efficiency improvements on a global and regional scale
- Potentials for renewable energy have a large impacts on the results e.g. wind in China

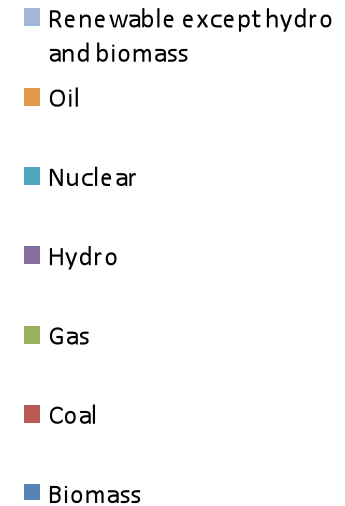
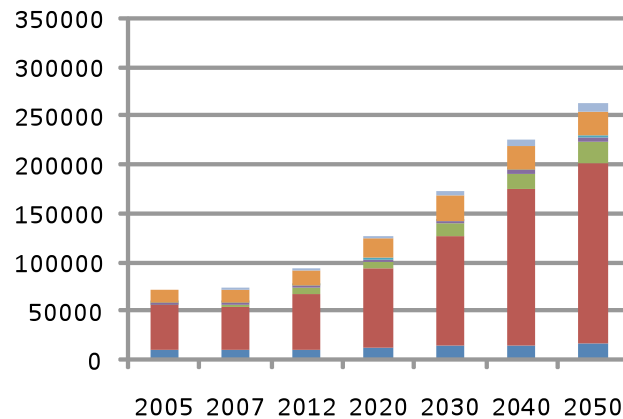


Primary energy, CHI, baseline

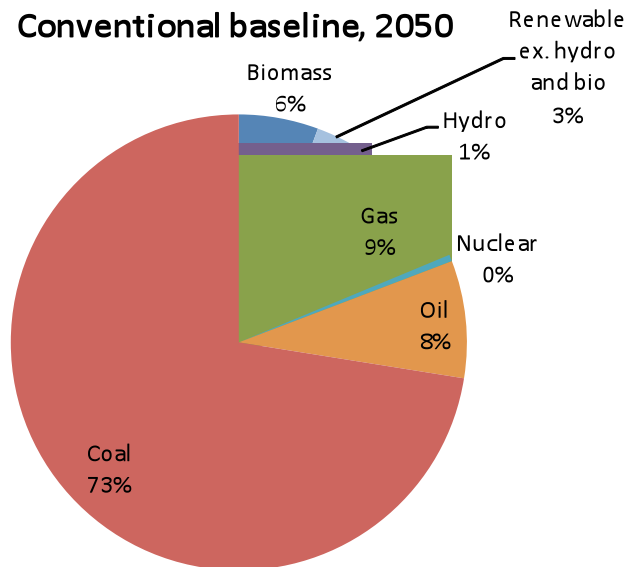
Primary energy by fuel in conventional baseline (PJ)



Primary energy by fuel in low baseline (PJ)



Conventional baseline, 2050



Low baseline, 2050

